Rock Sole Tagging in Hecate Strait, April 27-May 11, 1982

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ROCK SOLE TAGGING IN HECATE STRAIT, APRIL 27-MAY 11, 1982

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ABSTRACT

Harling, W. R., R. P. Foucher, and M. W. Saunders. 1982. Rock sole tagging in Hecate Strait, April 27-May 11, 1982. Can. Data Rep. Fish. Aquat. Sci. No. 355: iii + 54 p.

Rock sole (Lepidopsetta bilineata) were tagged in Hecate Strait during April-May 1982 to delineate stocks and validate age determination methods. Tagging took place on two spawning grounds, one in International Area 5D and one in International Area 5C.

A total of 10,612 rock sole were tagged and released and all but 582 were injected with oxytetracycline for validation of otolith readings. Secondary activities included collecting data on rock sole gonad condition, Pacific cod (Gadus macrocephalus) size composition, and vertical profiles of water temperature.

Key words: Rock sole, tagging, stock delineation, age determination validation, Hecate Strait.

RÉSUMÉ

Harling, W. R., R. P. Foucher, and M. W. Saunders. 1982. Rock sole tagging in Hecate Strait, April 27-May 11, 1982. Can. Data Rep. Fish. Aquat. Sci. No. 355: iii + 54 p.

En avril et mai 1982, on a étiqueté des soles du Pacifique (Lepidopsetta bilineata) du détroit d'Hécate afin de délimiter les stocks et valider la scalimétrie de cette espèce. L'étiquetage a eu lieu dans deux aires de fraie, soit les zones internationales 5D et 5C.

Au total, 10 612 soles du Pacifique ont été étiquetées et remises en liberté. Toutes sauf 582 ont reçu une injection d'oxytétracycline pour la validation des lectures d'otolithes. On a aussi recueilli des données sur la condition des gonades de la sole du Pacifique, sur la composition par taille de la morue du Pacifique (Gadus macrocephalus) et sur la distribution verticale de la température de l'eau.

Mots-clés: sole du Pacifique, étiquetage, délimitation des stocks, validation de la scalimétrie, détroit d'Hécate.

INTRODUCTION

Stock assessment of rock sole (Lepidopsetta bilineata) in Hecate Strait presents two problems of primary concern: 1) stock delineation; 2) age validation.

A two-stock theory has been advanced for rock sole in Hecate Strait. One stock is presumed to occupy the area north of 53°50' while another is resident in south central Hecate Strait. This hypothesis is based on historical catch and effort observations, Hecate Strait survey data (Stocker et al. 1981; Fargo, Hoyt et al. 1982; Fargo, Harling et al. 1982), early tagging studies (Forrester and Thomson 1969), and information provided by fishermen.

Recent innovations in ageing techniques at the Pacific Biological Station have indicated a longer life span (~25 yr) for rock sole than previously believed. These new techniques have increased the number of age groups subject to fishery exploitation, and resulted in reduced estimates for natural mortality rates.

Rock sole stock delineation theories in Hecate Strait remain uncorroborated and the significance to fishery production of known spawning concentrations has not been evaluated.

New ageing techniques are unvalidated for rock sole although they have been validated for other groundfish species using oxytetracycline (OTC).

A tagging experiment for rock sole on known spawning grounds was designed to answer the stock delineation question and provide validation for ageing techniques. This report summarizes results of the tagging operation carried out in Hecate Strait in April-May 1982.

MATERIALS AND METHODS

VESSEL AND FISHING GEAR

The charter vessel M/V FREE ENTERPRISE NO. 1 is a steel-hulled, 27-m (90-ft) stern trawler equipped with a Loran/plotter and bottom-expander echo sounder. The net used was a Yankee 36 otter trawl equipped with a heavy chain groundline. Bridles and sweeplines extended 64 m (210 ft) to 950-kg (2100-lb) Polyvalent trawl doors. Net mesh size was 13 cm (5 in). Deck layout of the vessel was particularly well suited to the tagging operation (Fig. 1).

FISHING PROCEDURE

Initially, haul locations were based on the best catch rates observed during a juvenile flatfish survey conducted in April 1982 (Fargo, Harling et al. 1982). Haul duration was continually adjusted (based on the yield from the previous haul) in an attempt to produce an optimum 400 rock sole for tagging. Maximum fishing time for any one haul was 35 min. Average haul duration was 22 min.

The trawl was wound onto a net drum and the codend lifted over the stern, strapped, and the contents discharged into a water bath (a fish pen lined with a plastic tarp) located amidships between the vessel hatches. Elapsed time from lifting to discharge seldom exceeded 30 sec. From the water bath, rock sole were transferred either with a dipnet or by hand into one of three, pre-tagging, holding tanks. A maximum of 100 fish were put into each of the two small tanks (780-L capacity) and the balance placed into the large one (2023-L capacity). When the desired number of rock sole was obtained, the remainder were set aside for a maturity sample and the balance of the catch discarded.

TAGGING

(a) Procedure

Rock sole were measured fork length to the nearest centimeter (e.g. 30 cm = 29.5 to 30.4, etc.), tagged, injected with oxytetracycline (OTC), and placed in the recovery tank (1748-L capacity).

When all holding tanks were being utilized, tagging occurred in two stages. Fish in the two small tanks were processed first. For most hauls, these tanks contained an anesthetic (MS 222--1 mL/50 L of water). When MS 222 was used, tagged fish were held in the recovery tank until the effects of the anesthetic had worn off (usually 15-30 min); examined for condition ("good" versus "poor"); then discharged overboard by tipping the recovery tank, which was held in a frame hinged on the ship's rail (Fig. 1). Once the recovery tank was re-filled, tagging proceeded on fish in the large holding tank. Since MS 222 was never used in this tank, rock sole were examined for condition immediately after each batch was tagged and dumped as previously described.

Two deck hoses supplied fresh sea water to the tanks. Water was circulated through the recovery tank continuously during the tagging process and through the holding tanks on a rotating basis. All holding tanks were drained and refilled after each haul.

(b) Tag type

Floy FD68B tags (9.5 cm long--2.5 cm nylon shank attached to a 7.0-cm length of No. 20 yellow vinyl tubing) were used exclusively. Tags were

inserted into the mid-body region of each fish (eyed side) and approximately midway between the lateral line and dorsal fin.

(c) OTC injections

Oxytetracycline was injected into rock sole at time of tagging to validate age determination methods on recaptured specimens. Injections were intramuscular rather than intraperitoneal because of the limited space between vital organs in the body cavity. Point of insertion was usually just forward of the tag location. Quantity injected was approximately 0.25 cc of OTC per kilogram of body weight based on results of laboratory experiments conducted on three species (rock sole, English sole, Pacific cod) prior to the tagging charter. Weight of individual fish was estimated with the formula $W = aL^b$ where W = grams; L = centimeters; $a = 0.4449 \times 10^{-2}$; b = 3.30. For practical purposes, dosages were assigned to selected length intervals with "homogeneous" weights, as follows:

Size range (cm)	Dosage (cc)
<30	0.05
30-34	0.10
35-39	0.15
40-44	0.25
45-48	0.35
49-50	0.45
>50	0.50

(d) Re-measuring

Occasional differences between length at tagging and at recapture, inconsistent with normal growth patterns, occur in most tagging programs. To determine to what extent measuring errors might contribute to anticipated discrepancies, several samples of rock sole were selected for re-measurement before release. Hauls were chosen by the vessel captain using a random number process (provided by PBS personnel). Both taggers and recorder were informed only after the sample had been tagged and placed in the recovery tanks. Fish were then removed by dipnet, length and tag number read to the recorder by both taggers, and the fish released overboard.

(e) Release location

To minimize recapture of tagged specimens during subsequent hauls, fish were usually dumped at some distance from the fishing area; (often to one side at a point midway along the haul). Release locations are listed in Appendix Table 1 in addition to those for the haul itself.

All latitudes and longitudes given in Appendix Table I are automatic conversions of the vessel's Loran/plotter and are subject to machine calibration error. The Loran readings themselves should be considered the more accurate.

Gonad condition

Sampling procedures for gonad condition of individual rock sole varied among hauls. For some hauls, the specimens were simply surplus to holding tank capacity. For others, they consisted of fish deemed unacceptable for tagging because of injury, etc. No attempt was made to sample a fixed percentage of each haul. A description of the criteria for gonad conditions is contained in Table 1.

RESULTS

GENERAL

In total, 56 hauls were completed in two International areas of Hecate Strait (Fig. 2). Principal fish species caught included:

Species	Estimated wt (kg)[a]	% of total catch
Rock sole	7,202	33
Pacific cod	4,952	22
Dogfish	3,928	18
Skates	3,751	17
Ratfish	1,214	5
Other	1,058	5
TOTAL:	22,005	100

[a]Based on an estimated percentage of each species in the total catch of each haul, the weight of which was estimated by the vessel captain.

Details of haul locations and catch composition are contained in Appendix Table 1.

TAGGING

In total, 10,612 tagged rock sole were released in the two major areas of Hecate Strait, as follows:

Area	Fishing locality	Haul no.	No. tagged	No. of hauls
5C	Reef Island Gully	4-11	2,228	8
	Cumshewa (inshore)	12-13	486	2
	Cumshewa (Reef Island Flats)	1-3; 30-36	2,362	10
	TOTAL:		5,076	20
5D	S.W. Seal Rocks (southern)	14-23; 29	1,098	11
	S.W. Seal Rocks (northern)	24-28; 37-55	4,070	23
	Butterworth Flats	56	368	1
	TOTAL:		5,536	36

Some difficulty was encountered when inserting the tag. Attempts to secure the anchor behind a neural spine often resulted in bleeding from the tag hole and prevented the tag from lying flat along the body surface. Releasing fish with tags not well implanted (skin tags) was not uncommon (670 of 10,612--6%).

Tag number series used during the charter were F77-81475 to F77-85099 and F82-032000 to F82-039222. A summary of tag numbers, by haul, is contained in Appendix Table 2.

Physical condition of tagged fish varied considerably by fishing locality (Table 2). Incidence of mortalities was highest at Cumshewa (inshore)--1.2%, while injuries resulting from a high incidence of other species in the catch (scale loss and fin damage) were greatest at southwest Seal Rocks (starfish/dogfish in the southern portion--7.5%; dogfish in the northern portion--15.3%). Tagging at Cumshewa was terminated prematurely because of the high mortality, and hampered at the southern portion of southwest Seal Rocks by the abundance of starfish in the net, which caused excessive abrasion and prolonged handling time from net to water bath. Detailed records of injuries by haul are contained in Appendix Table 3.

As the cruise progressed, it became apparent that an anesthetic was not always necessary. Many of the rock sole, particularly those in the northern tagging area, were quite docile, both before and after tagging. Fish captured at Cumshewa (inshore) appeared sluggish and mortality was high even before tagging. Tagging from haul 13 (second group--183 fish) was not even attempted because of the high mortality and poor condition of survivors. The reason for this has not been determined.

OTC injections

Oxytetracycline (OTC) was injected into 10,042 (95%) of the fish tagged and released. Only 582 specimens, from four hauls, were not injected, as follows:

Haul no.	Total number tagged	Number not injected with OTC
9	459	214
32	361	120
34	416	121
45	127	127
TOTAL:	1,363	582

Release of OTC from the injection hole (upon removal of the needle) occurred intermittently (660 of 10,612 fish--6%). Where it was obvious that most, if not all of the OTC was lost, a second injection was made and a notation of loss not recorded. For those specimens where an indeterminate amount was lost and noted, no subsequent injection was made.

Re-measuring

A total of six hauls were selected by the vessel captain for re-measuring after tagging. Due to time constraints, only one batch from each of the six hauls was re-measured. Disagreements between length at tagging and length at release never exceeded 1% for any one sample, and the average for all six samples (968 fish) was 0.6% (Table 3). Differences of ± 1 cm (104 specimens) were not included in these calculations and are assumed to be the result of rounding error. It must be noted that sampling errors may have occurred during either the tagging or re-measuring process. Because of inclement weather and time constraints, each fish was not checked against length at tagging as it was re-measured.

Gonad condition

A total of 1,565 rock sole--478 males and 1,087 females--were examined for gonad condition (Appendix Table 4). Among mature fish, 67% of the male gonads and 77% of female gonads were in post-spawning condition. The lowest percentage of spawned fish (spent and resting) was observed at Reef Island Gully-Cumshewa (inshore)--males = 26%; females = 57%: and the southern portion of southwest Seal Rocks Ground--males = 51%; females = 62% (Table 4).

OTHER BIOLOGICAL SAMPLING

Size composition of tagged rock sole was compiled by haul (Appendix Table 5), and by tagging locality for those untagged specimens set aside for

assessment of maturity condition (Appendix Table 6). Modal frequencies varied considerably by fishing locality. Length-frequency samples of Pacific cod were collected when catch was sufficient and time permitted (Appendix Table 7).

WATER TEMPERATURES

Four expendable bathythermograph (XBT) casts were completed before the unit became inoperative. Mean temperatures at standard depths for these stations (A, B, C, D, in Fig. 2) were:

Depth (fm)	Mean temp. (°C)	No. of observations
0	8.0	4
10	7.8	4
20	7.8	3
30	7.7	3
40	7.6	2
50	7.5	2
100	6.7	1

In addition, several surface temperatures were collected in the areas of tagging. These ranged from 7.8-8.4°C with a mean of 8.0°C.

COMMENTS

Using a water bath greatly reduced the time rock sole were out of water, particularly when catch composition required considerable sorting.

Several sequential numbering reversals or missing tag numbers from the series, as supplied by the manufacturer, were encountered. Use of the F77 series was terminated when the yellow vinyl was observed to pull away from the nylon shank.

The recovery tank lacked a flow diffuser (a perforated length of pipe inserted through a hole in the tank lid and capped on the bottom end). Consequently, the hose circulating fresh sea water would frequently establish a considerable "current" within the tank and this may have accounted for some specimens being in "poor" shape at time of release.

PERSONNEL

W. R. Harling (i/c)	Pacific Biological Station	April 27-May 11
R. P. Foucher	Pacific Biological Station	April 27-May 11
M. W. Saunders	Pacific Biological Station	April 27-May 11

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Table 1. Criteria used for determining rock sole gonad condition during Hecate Strait tagging cruise, April 27-May 11, 1982.

Code no.	Title	Description
		Female
1	Immature	Ovaries very small, translucent or pinkish and somewhat gelatinous in texture.
2	Maturing	Ovaries relatively small, pinkish yellow or cream in colour, granular in texture. No distinct eggs visible.
3	Developing	Ovaries large, cream or yellow in colour, containing opaque eggs that can be distinguished by direct observation. Sex may be determined externally.
4	Gravid	Ovaries containing partly or wholly translucent eggs. Sex easily determined externally.
5	Spawning	Ovaries containing entirely translucent, mature, ova. Eggs loose and will run from oviducts under slight pressure.
6	Spent	Ovaries large, flaccid and purple in colour; a few translucent eggs may be left. Ovarian membrane very vascular (bloodshot) and sac-like.
7	Resting	Ovaries contracted and firm, pinkish-grey to creamy-yellow in colour, and may appear granular in texture but no distinct eggs are visible.
		Male
1	Immature	Testes very small, string-like, and somewhat translucent or pinkish in colour.
2	Maturing	Testes enlarging. A distinct bulge evident but still translucent or pinkish in colour.
3	Developing	Testes enlarging, brown-white or white in colour, firm in texture.
4	Ripe	Testes large, white, and easily broken. No running sperm evident.
5	Running	Testes large, white, and running sperm evident.

Table 1 (cont'd)

Code no.	Title	Description
		Male (cont'd)
6	Spent	Testes flaccid, shrunken and yellow-brown or olive-brown in colour. Sperm ducts enlarged and a small amount of running sperm may be present.
7	Resting	Testes firm, small, and yellow-brown or olive-brown in colour. Sperm ducts small.

Table 2. Physical condition (%), by fishing area, of rock sole tagged in Hecate Strait, April 27-May 11, 1982.

Area	Fishing locality	No. tagged	Percent injury by type[a] at time of tagging							Condition at release (%)	
			B	C	F	L	X	I	Total	Dead	Poor[b]
	Reef I. Gully	2,236	1.3	0.2	0.8	0.4	0.2	0.1	3.1	0.4	1.9
5C	Cumshewa (inshore)	486	2.1	-	0.4	0.2	0.2	-	2.9	1.2	7.4
	Cumshewa (Reef I. Flats)	2,366	2.4	-	0.8	1.4	Tr.	0.2	4.9	0.2	1.2
	S.W. Seal Rocks (southern)	1,103	2.7	0.2	2.3	1.9	0.3	0.1	7.5	0.5	6.0
5D	S.W. Seal Rocks[c] (northern)	4,442	2.3	0.5	3.6	7.5	0.3	1.2	15.3	0.1	3.2

[a] B = bleeding at tag hole
C = cut or lesion
F = fin torn
L = loss of scales
X = extruded gut
I = other or multiple injuries

[b] Fish were extremely sluggish, disoriented, or swimming on the surface of tank water.

[c] Includes one haul on Butterworth Flats.

Table 3. Incidence of measurement errors during rock sole tagging in Hecate Strait--April 27-May 11, 1982.

Haul no.	No. of fish remeasured	Disagreement		Fork length (cm)		
		%	(No.)	Tagging	Remeasure	Difference
8	200	0.5	(1)	42	44	+2
23	106	0.9	(1)	37	47	+10
33	161	0.6	(1)	37	42	+5
35	219	0.9	(2)	45	35	-10
				39	32	-7
42	147	0	-			
47	135	0.7	(1)	44	34	-10
TOTAL	968	0.6	(6)			

Table 4. Mature rock sole gonad condition (%) by fishing locality in Hecate Strait, April 27-May 11, 1982.

Gonad condition	Fishing locality			
	Reef Island-Cumshewa (inshore)	Cumshewa (Reef I. Flats)	SW Seal Rocks (southern)	SW Seal Rocks[a] (northern)
		Males		
3 Developing	3	-	2	-
4 Ripe	12	1	6	-
5 Running	46	5	41	14
6 Spent	13	23	37	19
7 Resting	13	72	14	67
% spawned	26	95	51	86
		Females		
3 Opaque eggs	18	7	33	14
4 Gravid eggs	4	2	4	2
5 Spawning	2	1	2	-
6 Spent	32	20	25	9
7 Resting	25	70	37	75
% spawned	57	90	62	84

[a]Includes one haul at Butterworth Flats.

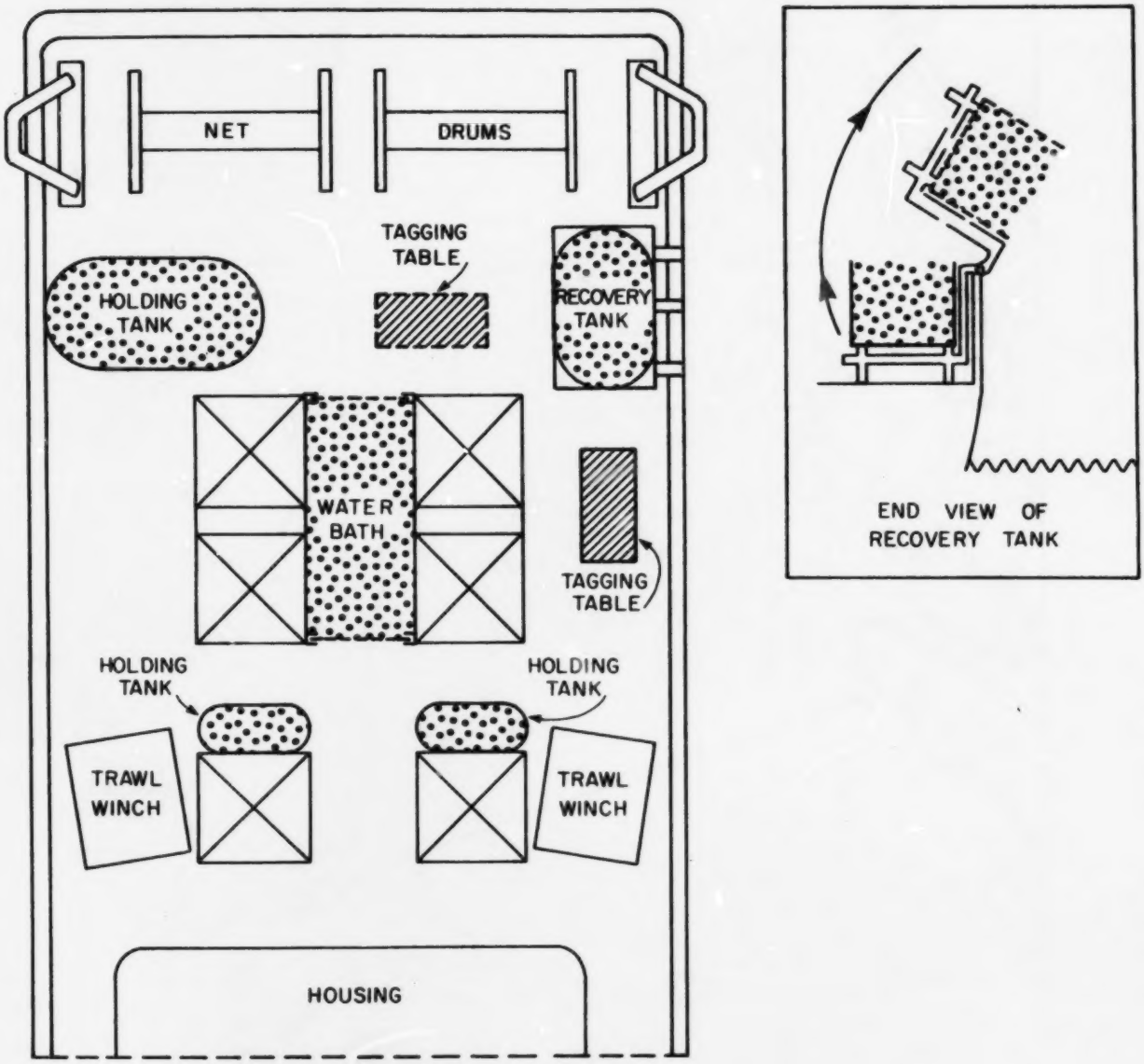

Fig. 1. Sketch (not to scale) of M/V FREE ENTERPRISE No.1 deck layout showing location of fish tanks, etc.

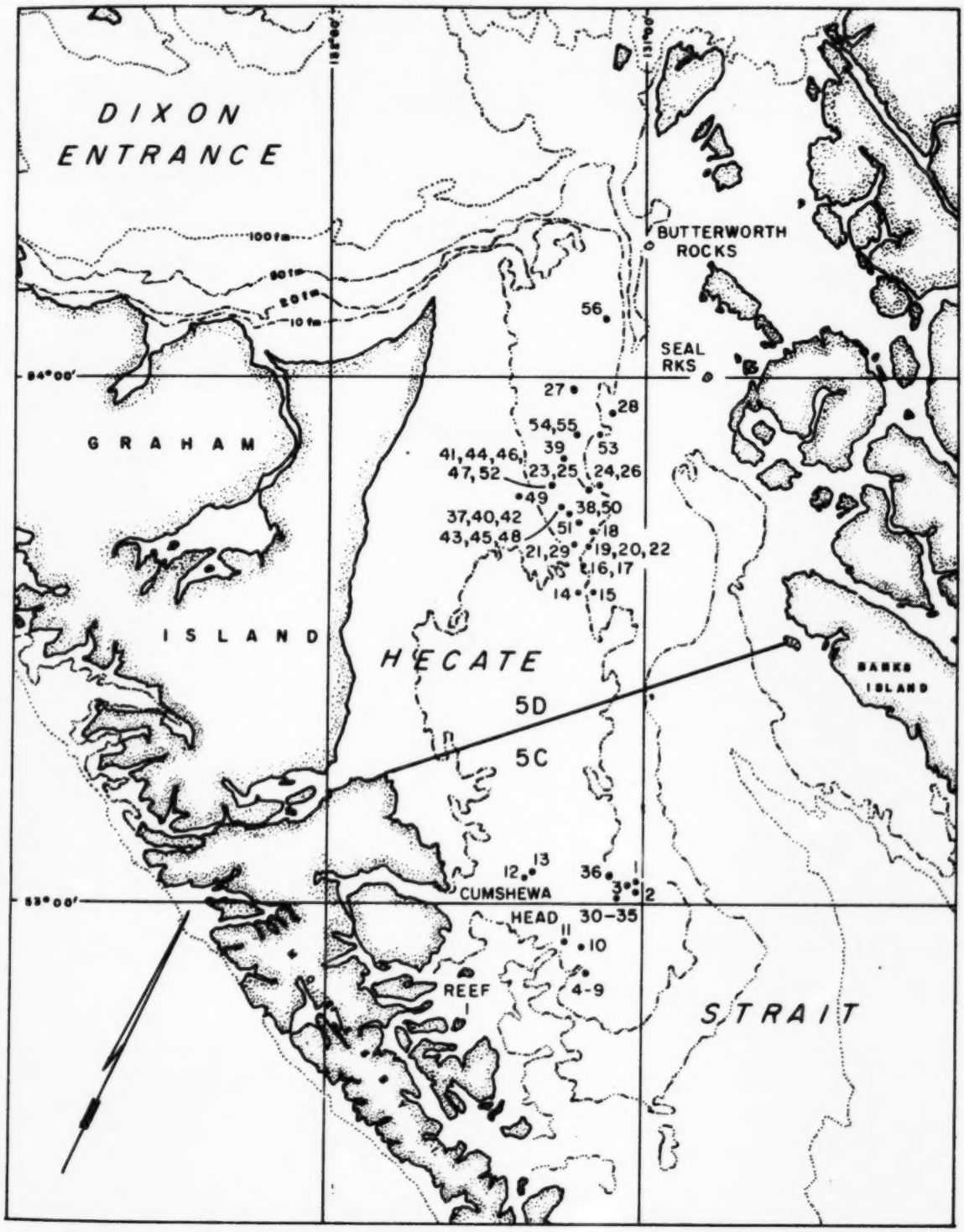

Fig. 2. Location of hauls completed during a rock sole tagging charter in Hecate Strait, April 27-May 11, 1982.

APPENDIX TABLES

Appendix Table 1. Fishing log for M/V FREE ENTERPRISE #1 rock sole tagging charter in Hecate Strait--April 27-May 11, 1982 (see footnote for explanation of terms).

Haul no.		1	2	3	4	5
Date		Apr. 29	Apr. 29	Apr. 29	May 1	May 1
Area[a]		RF	RF	RF	RG	RG
Time start (PDT)[b]		1852	2111	2331	0811	1110
Duration (min)		25	22	24	15	15
Start: N. Lat.	°	53	53	53	52	52
	'	01.0	02.3	00.1	51.9	52.1
W. Long.	°	131	131	131	131	131
	'	01.4	01.2	02.3	13.8	13.2
Loran: 5990 X		12243.6	12235.4	12246.2	12259.0	12260.1
Y		30408.7	30412.4	30405.8	30336.1	30377.1
Z		41493.1	41498.0	41489.3	41449.3	41450.6
Direction (°M)[c]		317	150	310	210	210
Finish: N. Lat.	°	53	53	53	52	53
	'	02.6	01.0	01.5	51.7	51.6
W. Long.	°	131	131	131	131	131
	'	01.4	01.1	03.0	15.1	14.5
Loran: 5990 X		12232.3	12244.7	12234.1	12255.7	12258.6
Y		30413.2	30409.2	30409.2	30374.6	30374.8
Z		41499.1	41493.8	41493.6	41447.2	41447.6
Depth (fm)[d]		20	19-20	19	28-35	26-27
Surface temp. (°C)		-	-	-	-	-
Total catch (kg)[e]		364	91	182	227	500
Remarks		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	1	2	3	4	5
Date	Apr. 29	Apr. 29	Apr. 29	May 1	May 1
Areaa	RF	RF	RF	RG	RG
Release location					
First: N. Lat. °	53	53	53	52	52
'	02.6	01.0	01.5	52.1	52.0
W. Long. °	131	131	131	131	131
'	01.4	01.1	03.0	12.0	11.5
Second: N. Lat. °	-	-	-	-	52
'	-	-	-	-	52.3
W. Long. °	-	-	-	-	131
'	-	-	-	-	11.6
Total catch (kg)	364	91	182	227	500
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	1	9	2	10
English sole	-	-	-	-	-
Halibut	18	3	9	-	-
Rock sole	91	23	36	182	425
Sand sole	-	Tr.	-	18	10
Other	-	-	-	-	-
Roundfish					
Pacific cod	18	5	18	-	Tr.
S. caurinus	-	-	Tr.	-	-
Other	18	Tr.	-	Tr.	-
Selachii					
Dogfish	-	2	-	-	-
Ratfish	18	2	18	18	10
Skate	18	2	Tr.	-	10
Invertebrates					
Anemone	-	-	-	-	-
Octopus	-	-	-	-	Tr.
Seapens	182	55	91	-	-
Sponge	-	-	-	-	-
Squid	Tr.	-	-	-	-
Starfish	Tr.	-	-	2	20
Urchin	-	-	Tr.	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		6	7	8	9	10
Date		May 1	May 1	May 1	May 2	May 2
Area[a]		RG	RG	RG	RG	RG
Time start (PDT)[b]		1320	1551	1852	1014	1450
Duration (min)		10	14	16	16	14
Start: N. Lat.	°	52	52	52	52	52
	'	52.0	52.1	51.9	52.2	56.6
W. Long.	°	131	131	131	131	131
	'	13.5	13.2	13.9	12.9	14.6
Loran: 5990 X		12259.7	12259.9	12258.9	12260.2	12223.8
Y		30376.5	30377.0	30376.0	30377.5	30388.6
Z		41440.9	41450.5	41449.1	41451.2	41464.6
Direction (°M)[c]		210	210	050	200	355
Finish: N. Lat.	°	52	52	52	52	52
	'	51.6	51.8	52.4	51.7	57.3
W. Long.	°	131	131	131	131	131
	'	14.3	14.4	12.7	14.4	14.0
Loran: 5990 X		12259.0	12257.6	12259.5	12258.2	12221.6
Y		30375.1	30375.4	30378.3	30375.2	30390.8
Z		41447.9	41448.3	41452.1	41448.0	41467.5
Depth (fm)[d]		25	26-33	27-26	26-28	29
Surface temp. (°C)		-	-	-	-	-
Total catch (kg)[e]		409	455	318	364	455
Remarks		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		6	7	8	9	10
Date		May 1	May 1	May 1	May 2	May 2
Area[a]		RG	RG	RG	RG	RG
Release location						
First: N. Lat.	°	52	52	52	52	52
	'	52.0	52.1	52.1	52.0	55.2
W. Long.	°	131	131	131	131	131
	'	11.5	11.6	11.6	11.4	13.1
Second: N. Lat.	°	52	52	-	52	-
	'	52.1	52.1	-	52.1	-
W. Long.	°	131	131	-	131	-
	'	11.6	11.5	-	11.6	-
Total catch (kg)		409	455	318	364	455
Flatfish						
Butter sole		-	-	-	-	-
Curlfin sole		-	-	-	Tr.	-
English sole		-	-	-	-	-
Halibut		-	-	-	-	-
Rock sole		327	364	254	346	23
Sand sole		20	23	16	7	-
Other		-	-	-	-	-
Roundfish						
Pacific cod		-	-	-	-	-
S. caurinus		-	-	-	-	-
Other		-	-	-	-	15
Selachii						
Dogfish		-	-	Tr.	-	-
Ratfish		20	45	16	4	409
Skate		-	-	-	7	-
Invertebrates						
Anemone		-	-	-	-	-
Octopus		-	-	16	-	3
Seapens		-	-	-	-	-
Sponge		-	-	-	-	-
Squid		-	-	-	-	-
Starfish		28	23	16	Tr.	-
Urchin		-	-	-	-	5
Other		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	11	12	13	14	15
Date	May 2	May 2	May 2	May 3	May 3
Area[a]	RG	CUM.	CUM.	SR(s)	SR(s)
Time start (PDT)[b]	1740	1945	2244	0830	1030
Duration (min)	18	20	24	24	15
Start: N. Lat. °	52	53	53	53	53
'	56.4	03.0	03.0	36.6	36.8
W. Long. °	131	131	131	131	131
'	14.9	20.9	20.8	16.0	11.6
Loran: 5990 X	12224.1	12156.1	12157.0	11927.8	11942.4
Y	30387.9	30402.0	30402.0	30488.5	30491.8
Z	41463.7	41480.5	41480.4	41598.5	41604.4
Direction (°M)[c]	180	210	230	145	110
Finish: N. Lat. °	52	53	53	53	53
'	55.6	03.1	02.8	35.5	36.3
W. Long. °	131	131	131	131	131
'	15.8	22.8	23.0	15.7	10.6
Loran: 5990 X	12226.3	12149.1	12150.1	11937.4	11949.6
Y	30385.0	30401.0	30400.2	30486.0	30491.1
Z	41460.0	41478.8	41477.6	41595.0	41603.7
Depth (fm)[d]	26	18	19-20	14	24-27
Surface temp. (°C)	-	-	-	-	-
Total catch (kg)[e]	909	227	545	637	-
Remarks	Rocks, ratfish	-	-	Mostly starfish	Ripped out belly. Boulder in net. Unusable

Appendix Table 1 (cont'd)

Haul no.	11	12	13	14	15
Date	May 2	May 2	May 2	May 3	May 3
Area[a]	RG	CUM	CUM	SR(s)	SR(s)
Release location					
First: N. Lat. °	52	53	53	53	53
'	55.6	03.1	03.5	36.3	36.3
W. Long. °	131	131	131	131	131
'	15.8	22.9	21.9	12.9	10.6
Second: N. Lat. °	-	-	-	-	-
'	-	-	-	-	-
W. Long. °	-	-	-	-	-
'	-	-	-	-	-
Total catch (kg)	909	227	545	637	-
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	-	-	-	-
English sole	-	-	-	-	-
Halibut	-	-	-	37	-
Rock sole	44	227	-	91	-
Sand sole	-	-	-	-	-
Other	-	-	-	-	-
Roundfish					
Pacific cod	159	-	-	-	-
S. caurinus	-	-	-	-	-
Other	-	-	-	-	-
Selachii					
Dogfish	-	-	-	-	-
Ratfish	606	-	-	9	-
Skate	-	-	-	18	-
Invertebrates					
Anemone	-	-	-	-	-
Octopus	30	-	-	-	-
Seapens	-	-	-	9	-
Sponge	-	-	-	-	-
Squid	-	-	-	-	-
Starfish	20	-	-	473	-
Urchin	50	-	-	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		16	17	18	19	20
Date		May 3	May 3	May 3	May 4	May 4
Area[a]		SR(s)	SR(s)	SR(s)	SR(s)	SR(s)
Time start (PDT)[b]		1600	1747	1851	0721	0912
Duration (min)		24	8	23	10	15
Start: N. Lat.	°	53	53	53	53	53
	'	37.6	39.5	37.3	41.3	41.3
W. Long.	°	131	131	131	131	131
	'	12.2	12.4	04.2	10.5	09.9
Loran: 5990 X		11934.1	11918.8	11966.3	11911.5	11913.6
Y		30493.1	30497.4	30497.5	30502.7	30503.1
Z		41606.1	41612.4	41614.9	41620.4	41621.3
Direction (°M)[c]		320	160	050	140	160
Finish: N. Lat.	°	53	53	53	53	53
	'	39.0	39.0	37.7	40.7	40.4
W. Long.	°	131	131	131	131	131
	'	12.6	12.4	02.1	10.6	10.5
Loran: 5990 X		11921.9	11922.1	11970.5	11916.2	11918.8
Y		30496.0	30496.3	30500.1	30501.3	30500.6
Z		41610.2	41610.7	41619.4	41618.4	41617.4
Depth (fm)[d]		14-16	24	25-26	22	25
Surface temp. (°C)		-	-	-	-	-
Total catch (kg)[e]		2,272	227	545	250	318
Remarks		Mostly starfish Unusable.	Mostly starfish.			

Appendix Table 1 (cont'd)

Haul no.		16	17	18	19	20
Date		May 3	May 3	May 3	May 4	May 4
Area[a]		SR(s)	SR(s)	SR(s)	SR(s)	SR(s)
Release location						
First: N. Lat.	°	53	53	53	53	53
	'	39.0	39.1	42.3	41.0	41.1
W. Long.	°	131	131	131	131	131
	'	12.6	12.4	10.7	12.0	12.1
Second: N. Lat.	°	-	-	52	53	-
	'	-	-	42.4	41.1	-
W. Long.	°	-	-	131	131	-
	'	-	-	11.3	12.2	-
Total catch (kg)		2,272	227	545	250	318
Flatfish						
Butter sole		-	-	-	-	-
Curlfin sole		-	7	-	Tr.	-
English sole		-	11	-	-	-
Halibut		-	-	11	-	7
Rock sole		45	34	98	200	80
Sand sole		-	-	-	Tr.	7
Other		-	-	-	-	-
Roundfish						
Pacific cod		-	-	-	13	3
S. caurinus		-	-	-	-	-
Other		-	-	-	-	-
Selachii						
Dogfish		-	-	Tr.	Tr.	-
Ratfish		-	5	-	Tr.	-
Skate		-	34	163	25	19
Invertebrates						
Anemone		-	-	-	-	-
Octopus		-	-	-	-	-
Seapens		409	-	-	-	-
Sponge		-	-	-	-	3
Squid		-	-	-	-	-
Starfish		1,818	136	273	12	190
Urchin		-	-	-	-	-
Other		-	-	-	-	3

Appendix Table 1 (cont'd)

Haul no.	21	22	23	24	25
Date	May 4	May 4	May 4	May 4	May 4
Area[a]	SR(s)	SR(s)	SR(s)	SR(n)	SR(n)
Time start (PDT)[b]	1033	1217	1453	1700	1848
Duration (min)	17	20	19	14	27
Start: N. Lat. °	53	53	53	53	53
'	42.6	41.4	43.8	47.0	48.6
W. Long. °	131	131	131	131	131
'	15.3	10.4	17.2	10.0	10.0
Loran: 5990 X	11884.5	11911.6	11868.1	11864.8	11856.5
Y	30502.5	30502.8	30504.0	30516.9	30519.3
Z	41618.7	41620.6	41620.2	41640.7	41644.7
Direction (°M)[c]	140	155	110	260	300
Finish: N. Lat. °	53	53	53	53	53
'	41.6	39.8	42.7	47.8	50.2
W. Long. °	131	131	131	131	131
'	15.2	11.1	16.4	11.9	10.5
Loran: 5990 X	11892.5	11920.7	11879.7	11856.1	11842.5
Y	30500.1	30499.0	30501.9	30516.2	30522.3
Z	41615.3	41614.8	41617.4	41639.5	41648.8
Depth (fm)[d]	27	24-23	21-25	24	24
Surface temp. (°C)	-	-	-	-	-
Total catch (kg)[e]	4,545	455	682	159	455
Remarks	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		21	22	23	24	25
Date		May 4	May 4	May 4	May 4	May 4
Area[a]		SR(s)	SR(s)	SR(s)	SR(n)	SR(n)
Release location						
First: N. Lat.	°	53	53	53	53	53
	'	41.6	41.1	47.7	48.2	47.8
W. Long.	°	131	131	131	131	131
	'	15.2	12.3	12.4	09.7	12.3
Second: N. Lat.	°	-	-	-	-	-
	'	-	-	-	-	-
W. Long.	°	-	-	-	-	-
	'	-	-	-	-	-
Total catch (kg)		4,545	455	682	159	455
Flatfish						
Butter sole		-	-	137	-	-
Curlfin sole		-	Tr.	34	-	-
English sole		45	-	68	-	-
Halibut		-	-	-	-	-
Rock sole		Tr.	45	34	32	68
Sand sole		-	-	-	-	-
Other		Tr.	-	-	-	-
Roundfish						
Pacific cod		4,318	-	34	-	-
S. caurinus		-	-	-	-	-
Other		-	Tr.	-	-	-
Selachii						
Dogfish		-	Tr.	-	32	137
Ratfish		-	-	-	-	-
Skate		45	114	137	24	136
Invertebrates						
Anemone		-	-	-	8	23
Octopus		-	-	-	-	-
Seapens		-	-	-	-	-
Sponge		-	-	68	8	-
Squid		-	-	-	-	-
Starfish		137	296	170	55	91
Urchin		-	-	-	-	-
Other		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	26	27	28	29	30
Date	May 4	May 6	May 6	May 7	May 7
Areaa	SR(n)	SR(n)	SR(n)	SR(s)	RF
Time start (PDT)b	1952	1600	2130	0025	1000
Duration (min)	25	20	10	20	24
Start: N. Lat. °	53	54	53	53	53
'	49.5	03.0	57.4	41.5	03.5
W. Long. °	131	131	131	131	131
'	11.0	05.4	06.5	10.6	02.4
Loran: 5990 X	11844.4	11759.3	11799.8	11910.0	12222.1
Y	30520.5	30552.7	30540.0	30502.9	30414.9
Z	41646.0	41696.1	41675.7	41620.5	41501.1
Direction (°M)c	150	170	160	140	235
Finish: N. Lat. °	53	54	53	53	53
'	48.2	01.7	56.2	40.0	03.6
W. Long. °	131	131	131	131	131
'	11.5	05.5	07.6	11.1	04.6
Loran: 5990 X	11854.6	11769.3	11805.2	11918.3	12212.9
Y	30517.3	30549.6	30518.4	30498.9	30413.6
Z	41641.2	41691.5	41673.3	41615.9	41498.7
Depth (fm)d	21-20	17-16	29	23-25	19-21
Surface temp. (°C)	-	-	-	-	7.8
Total catch (kg)e	159	182	91	318	45
Remarks	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	26	27	28	29	30
Date	May 4	May 6	May 6	May 7	May 7
Area[a]	SR(n)	SR(n)	SR(n)	SR(s)	RF
Release location					
First: N. Lat. °	53	53	53	53	53
'	48.2	58.6	56.2	40.7	00.6
W. Long. °	131	131	131	131	131
'	11.5	15.1	07.6	13.5	05.8
Second: N. Lat. °	-	-	-	53	-
'	-	-	-	42.1	-
W. Long. °	-	-	-	131	-
'	-	-	-	15.0	-
Total catch (kg)	159	182	91	318	45
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	-	2	-	-
English sole	-	-	-	-	-
Halibut	-	2	5	-	-
Rock sole	15	91	10	91	22
Sand sole	-	-	Tr.	-	-
Other	-	-	-	-	-
Roundfish					
Pacific cod	-	-	-	-	-
S. caurinus	-	-	Tr.	22	-
Other	-	5	9	23	-
Selachii					
Dogfish	72	23	14	-	-
Ratfish	-	-	-	-	9
Skate	72	45	47	91	5
Invertebrates					
Anemone	-	-	2	-	-
Octopus	-	-	-	-	-
Seapens	-	-	-	-	-
Sponge	-	-	-	-	-
Squid	-	-	-	-	-
Starfish	-	16	-	91	9
Urchin	-	-	-	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		31	32	33	34	35
Date		May 7	May 7	May 7	May 7	May 7
Area[a]		RF	RF	RF	RF	RF
Time start (PDT)[b]		1056	1136	1330	1535	1800
Duration (min)		23	30	30	30	30
Start: N. Lat.	°	53	53	53	53	53
	'	04.8	03.1	03.2	03.3	03.4
W. Long.	°	131	131	131	131	131
	'	06.7	05.1	04.8	05.1	05.5
Loran: 5990 X		12196.3	12214.7	12214.7	12212.9	12211.1
Y		30415.5	30412.0	30412.7	30412.7	30412.5
Z		41500.9	41496.7	41497.6	41497.6	41497.3
Direction (°M)[c]		110	163	165	160	180
Finish: N. Lat.	°	53	53	53	53	53
	'	03.7	01.6	01.5	01.4	01.2
W. Long.	°	131	131	131	131	131
	'	05.4	05.9	05.5	06.2	06.5
Loran: 5990 X		12209.3	12222.2	12224.5	12222.5	12222.5
Y		30413.5	30407.5	30407.4	30406.8	30406.1
Z		41498.6	41490.5	41490.5	41489.7	41488.8
Depth (fm)[d]		25	18	17-18	18	17
Surface temp. (°C)		7.8	-	-	-	-
Total catch (kg)[e]		68	364	364	227	545
Remarks		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	31	32	33	34	35
Date	May 7	May 7	May 7	May 7	May 7
Area[a]	RF	RF	RF	RF	RF
Release location					
First: N. Lat. °	53	53	53	53	53
'	00.6	00.8	00.2	00.7	00.2
W. Long. °	131	131	131	131	131
'	05.8	05.5	05.1	05.6	05.4
Second: N. Lat. °	-	52	53	53	53
'	-	00.5	00.7	00.6	00.2
W. Long. °	-	131	131	131	131
'	-	05.6	05.6	05.4	10.5
Total catch (kg)	68	364	364	227	545
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	-	-	-	-
English sole	-	-	-	-	-
Halibut	-	-	-	-	91
Rock sole	14	255	255	193	417
Sand sole	17	-	-	5	5
Other	-	-	-	-	-
Roundfish					
Pacific cod	7	-	7	-	-
S. caurinus	-	-	-	-	-
Other	10	-	11	-	-
Selachii					
Dogfish	-	-	7	-	-
Ratfish	3	18	4	-	-
Skate	7	55	55	23	27
Invertebrates					
Anemone	-	-	-	-	-
Octopus	-	-	-	-	-
Seapens	3	18	18	4	-
Sponge	-	-	-	-	-
Squid	-	-	-	-	-
Starfish	7	18	7	2	5
Urchin	-	-	-	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		36	37	38	39	40
Date		May 7	May 8	May 8	May 8	May 8
Area[a]		RF	SR(n)	SR(n)	SR(n)	SR(n)
Time start (PDT)[b]		2110	0845	1007	1124	1320
Duration (min)		22	21	20	25	20
Start: N. Lat.	°	53	53	53	53	53
	'	01.0	47.4	45.2	46.7	49.7
W. Long.	°	131	131	131	131	131
	'	06.5	16.6	15.4	16.5	17.2
Loran: 5990 X		12223.6	11842.6	11864.2	11848.4	11822.5
Y		30405.7	30512.2	30508.1	30510.7	30516.9
Z		41488.1	41632.2	41626.7	41630.0	41638.5
Direction (°M)[c]		340	135	120	310	150
Finish: N. Lat.	°	53	53	53	53	53
	'	03.1	46.0	44.0	47.8	48.4
W. Long.	°	131	131	131	131	131
	'	05.6	16.0	14.7	17.5	17.3
Loran: 5990 X		12213.0	11855.8	11875.8	11836.2	11831.7
Y		30411.7	30509.4	30505.8	30512.6	30514.0
Z		41496.1	41628.6	41623.8	41632.5	41634.6
Depth (fm)[d]		18	22	23	20	21
Surface temp. (°C)		8.1	-	7.8	-	-
Total catch (kg)[e]		682	455	3,636	364	227
Remarks		-	-	Mostly dogfish	-	-

Appendix Table 1 (cont'd)

Haul no.	36	37	38	39	40
Date	May 7	May 8	May 8	May 8	May 8
Area[a]	RF	SR(n)	SR(n)	SR(n)	SR(n)
Release location					
First: N. Lat. °	53	53	53	53	53
'	02.7	45.7	44.0	50.4	46.0
W. Long. °	131	131	131	131	131
'	06.4	17.1	14.7	16.3	18.6
Second: N. Lat. °	53	-	-	53	-
'	02.8	-	-	48.4	-
W. Long. °	131	-	-	131	-
'	07.1	-	-	18.5	-
Total catch (kg)	682	455	3,636	364	227
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	-	-	-	-
English sole	-	-	-	-	-
Halibut	-	-	-	-	-
Rock sole	682	114	-	291	23
Sand sole	-	23	-	-	Tr.
Other	-	-	-	-	-
Roundfish					
Pacific cod	-	-	364	-	-
S. caurinus	-	-	-	-	-
Other	-	-	-	-	-
Selachii					
Dogfish	-	91	2,909	18	11
Ratfish	-	-	-	-	-
Skate	-	68	364	-	34
Invertebrates					
Anemone	-	-	-	-	-
Octopus	-	-	-	-	-
Seapens	-	-	-	-	-
Sponge	-	45	-	37	45
Squid	-	23	-	-	-
Starfish	-	91	-	18	114
Urchin	-	-	-	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		41	42	43	44	45
Date		May 8	May 8	May 8	May 8	May 9
Area[a]		SR(n)	SR(n)	SR(n)	SR(n)	SR(n)
Time start (PDT)[b]		1410	1608	1724	1805	0718
Duration (min)		24	24	31	27	30
Start: N. Lat.	°	53	53	53	53	53
	'	47.4	46.6	48.2	46.0	46.3
W. Long.	°	131	131	131	131	131
	'	17.6	16.8	17.2	15.9	16.0
Loran: 5990 X		11836.2	11848.1	11834.3	11855.7	11854.1
Y		30512.4	30510.3	30513.5	30509.6	30511.0
Z		41632.1	41625.5	41634.1	41628.7	41629.2
Direction (°M)[c]		120	320	140	315	305
Finish: N. Lat.	°	53	53	53	53	53
	'	46.2	48.2	46.0	48.0	48.0
W. Long.	°	131	131	131	131	131
	'	16.7	17.3	16.2	16.8	16.6
Loran: 5990 X		11851.7	11833.8	11855.0	11836.8	11837.9
Y		30509.4	30513.6	30509.4	30513.4	30513.3
Z		41628.0	41634.0	41628.5	41633.9	41633.7
Depth (fm)[d]		21	22-21	22	23	22
Surface temp. (°C)		-	-	-	-	-
Total catch (kg)[e]		364	227	545	364	364
Remarks		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	41	42	43	44	45
Date	May 8	May 8	May 8	May 8	May 9
Area[a]	SR(n)	SR(n)	SR(n)	SR(n)	SR(n)
Release location					
First: N. Lat. °	53	51	53	53	53
'	48.8	45.8	45.5	48.0	45.9
W. Long. °	131	131	131	131	131
'	18.0	17.4	17.2	18.1	17.4
Second: N. Lat. °	-	-	53	-	-
'	-	-	48.6	-	-
W. Long. °	-	-	131	-	-
'	-	-	18.3	-	-
Total catch (kg)	364	227	545	364	364
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	-	-	-	-
English sole	-	-	-	-	-
Halibut	18	-	-	-	-
Rock sole	91	80	136	91	36
Sand sole	-	-	27	18	18
Other	-	-	-	-	-
Roundfish					
Pacific cod	-	-	-	-	-
S. caurinus	-	-	-	-	-
Other	-	-	-	-	-
Selachii					
Dogfish	55	80	126	91	-
Ratfish	-	-	-	-	-
Skate	55	56	82	55	91
Invertebrates					
Anemone	-	-	-	-	-
Octopus	-	-	-	-	-
Seapens	-	-	-	-	-
Sponge	18	-	164	109	146
Squid	-	-	-	-	-
Starfish	127	11	-	-	73
Urchin	-	-	-	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		46	47	48	49	50
Date		May 9	May 9	May 9	May 9	May 9
Area[a]		SR(n)	SR(n)	SR(n)	SR(n)	SR(n)
Time start (PDT)[b]		0825	0950	1140	1400	1615
Duration (min)		25	30	30	30	30
Start: N. Lat.	°	53	53	53	53	53
	'	47.9	45.7	47.7	45.5	47.8
W. Long.	°	131	131	131	131	131
	'	17.3	15.8	17.3	15.6	16.8
Loran: 5990 X		11835.7	11858.7	11837.4	11861.1	11838.8
Y		30512.9	30509.0	30512.4	30508.6	30512.9
Z		41632.9	41627.7	41632.0	41627.1	41632.9
Direction (°M)[c]		160	320	120	305	-
Finish: N. Lat.	°	53	53	53	53	53
	'	45.7	47.6	45.5	48.0	45.6
W. Long.	°	131	131	131	131	131
	'	15.9	17.1	15.5	17.8	15.4
Loran: 5990 X		11858.2	11839.2	11861.0	11834.4	11861.2
Y		30509.1	30512.2	30508.9	30513.0	30508.9
Z		41627.9	41631.8	41627.5	41632.5	41627.8
Depth (fm)[d]		19	21	19-24	22	29
Surface temp. (°C)		-	-	8.1	-	-
Total catch (kg)[e]		455	455	545	455	364
Remarks		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	46	47	48	49	50
Date	May 9	May 9	May 9	May 9	May 9
Areaa	SR(n)	SR(n)	SR(n)	SR(n)	SR(n)
Release location					
First: N. Lat. °	53	53	53	53	53
'	48.2	47.9	45.2	46.0	45.0
W. Long. °	131	131	131	131	131
'	18.7	18.8	17.6	24.9	16.4
Second: N. Lat. °	-	53	53	53	-
'	-	45.6	48.2	45.7	-
W. Long. °	-	131	131	131	-
'	-	16.9	18.6	19.9	-
Total catch (kg)	455	455	545	455	364
Flatfish					
Butter sole	-	-	-	-	-
Curlfin sole	-	-	-	-	-
English sole	-	-	-	-	-
Halibut	-	5	-	23	-
Rock sole	46	181	136	136	109
Sand sole	-	23	-	18	18
Other	-	-	-	-	-
Roundfish					
Pacific cod	-	-	-	-	-
S. caurinus	-	-	-	-	-
Other	-	-	-	-	-
Selachii					
Dogfish	14	23	27	5	18
Ratfish	-	-	-	-	-
Skate	9	23	109	23	-
Invertebrates					
Anemone	-	-	-	-	-
Octopus	-	-	-	-	-
Seapens	-	-	-	-	-
Sponge	227	200	273	250	219
Squid	-	-	-	-	-
Starfish	159	-	-	-	-
Urchin	-	-	-	-	-
Other	-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		51	52	53	54	55
Date		May 9	May 9	May 10	May 10	May 10
Area[a]		SR(n)	SR(n)	SR(n)	SR(n)	SR(n)
Time start (PDT)[b]		1855	2035	0820	0915	1018
Duration (min)		25	35	20	25	30
Start: N. Lat.	°	53	53	53	53	53
	'	41.3	45.1	52.2	51.7	53.3
W. Long.	°	131	131	131	131	131
	'	10.5	15.2	11.3	12.6	11.3
Loran: 5990 X		11911.8	11865.2	11815.2	11822.7	11815.1
Y		30502.6		30528.3	30524.1	30528.4
Z		41620.2	41626.5	41657.0	41650.8	41657.0
Direction (°M)[c]		160	315	180	350	190
Finish: N. Lat.	°	53	53	53	53	53
	'	39.4	47.8	52.2	53.1	51.6
W. Long.	°	131	131	131	131	131
	'	10.6	16.8	12.6	11.5	12.8
Loran: 5990 X		11926.4	11838.3	11819.0	11815.7	11823.0
Y		30498.2	30513.2	30525.2	30528.0	30523.7
Z		41613.9	41633.5	41652.1	41656.4	41649.9
Depth (fm)[d]		22-25	22	20	18	19-17
Surface temp. (°C)		-	8.3	-	8.4	-
Total catch (kg)[e]		227	682	91	136	182
Remarks		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.		51	52	53	54	55
Date		May 9	May 9	May 10	May 10	May 10
Areaa		SR(n)	SR(n)	SR(n)	SR(n)	SR(n)
Release location						
First: N. Lat.	°	53	53	53	53	53
	'	44.2	48.1	53.1	53.1	53.3
W. Long.	°	131	131	131	131	131
	'	14.2	19.8	10.3	11.5	11.9
Second: N. Lat.	°	-	-	-	-	-
	'	-	-	-	-	-
W. Long.	°	-	-	-	-	-
	'	-	-	-	-	-
Total catch (kg)		227	682	91	136	182
Flatfish						
Butter sole		-	-	-	-	-
Curlfin sole		-	-	-	-	-
English sole		-	34	-	-	-
Halibut		Tr.	34	5	-	-
Rock sole		45	136	32	75	91
Sand sole		-	-	-	-	9
Other		-	-	-	-	-
Roundfish						
Pacific cod		-	-	-	7	-
S. caurinus		-	-	-	-	-
Other		-	-	-	-	-
Selachii						
Dogfish		-	34	27	14	18
Ratfish		-	-	-	-	-
Skate		23	102	27	33	55
Invertebrates						
Anemone		-	-	-	-	-
Octopus		-	-	-	-	-
Seapens		-	-	-	7	4
Sponge		-	-	-	-	-
Squid		-	-	-	-	-
Starfish		159	342	-	-	5
Urchin		-	-	-	-	-
Other		-	-	-	-	-

Appendix Table 1 (cont'd)

Haul no.	56
Date	May 10
Area[a]	BF
Time start (PDT)[b]	1320
Duration (min)	30
Start: N. Lat. °	54
'	01.7
W. Long. °	131
'	05.5
Loran: 5990 X	11769.3
Y	30549.6
Z	41691.5
Direction (°M)[c]	320
Finish: N. Lat. °	54
'	03.0
W. Long. °	131
'	05.4
Loran: 5990 X	11759.3
Y	30552.7
Z	41696.1
Depth (fm)[d]	19
Surface temp. (°C)	-
Total catch (kg)[e]	364
Remarks	-

Haul no.	56
Date	May 10
Area[a]	BF
Release location	
First: N. Lat. °	54
'	06.9
W. Long. °	131
'	07.6
Second: N. Lat. °	-
'	-
W. Long. °	-
'	-
Total catch (kg)	364
Flatfish	
Butter sole	-
Curlfin sole	4
English sole	4
Halibut	36
Rock sole	182
Sand sole	-
Other	-
Roundfish	
Pacific cod	-
S. caurinus	-
Other	-
Selachii	
Dogfish	-
Ratfish	-
Skate	127
Invertebrates	
Anemone	-
Octopus	-
Seapens	-
Sponge	-
Squid	-
Starfish	11
Urchin	-
Other	-

Footnotes to Appendix Table 1.

[a]Area: BF = Butterworth Flats; CUM = Cumshewa (inshore); RF = Reef Island Flats (Cumshewa); RG = Reef Island Gully; SR(n) = SW Seal Rocks (northern portion); SR(s) = SW Seal Rocks (southern portion).

[b]Time Start: PDT = Pacific Daylight time.

[c]Direction: °M = degrees magnetic.

[d]Depth: fm = fathoms.

[e]Total catch: kg=estimated weight in kilograms.

Flatfish: butter sole (Isopsetta isolepis); curlfin sole (Pleuronichthys decurrens); English sole (Parophrys vetulus); halibut (Hippoglossus stenolepis); rock sole (Lepidopsetta bilineata); sand sole (Psettichthys melanostictus).

Roundfish: Pacific cod (Gadus macrocephalus); S. caurinus (copper rockfish).

Selachii: dogfish (Squalus acanthias); ratfish (Hydrolagus colliei); skate (Rajidae sp.).

Other (any group): all species whose estimated weight never exceeded 1% of the catch, or never more than 10 kg, in a single haul.

Flatfish: arrowtooth flounder (Atheresthes stomias), petrale sole (Eopsetta jordani); starry flounder (Platichthys stellatus).

Roundfish: greenling (Hexagrammid spp.); lingcod (Ophiodon elongatus); pink salmon (Oncorhynchus gorbuscha); S. maliger (quillback rockfish); sculpin (Cottidae); shiner perch (Cymatogaster aggregata); walleye pollock (Theregra chalcogramma); wolf-eel (Anarrhichthys ocellatus).

Invertebrates: crab; sea cucumber.

Appendix Table 2. Summary of rock sole tagging by haul in Hecate Strait, April 27-May 11, 1982.

Haul no.	Tagged and released		Missing from series[a]	
	No.	Serial number	No.	Serial number
		F77 series		
1	147	81475-81624	2	81499, 569
2	71	81625-81690; 81700-81704	-	
3	63	81691-99; 81705-81763	4	81707,708, 715, 716
4	171	81764-81919; 81925-81943	3	81856, 878, 905
5	328	81920-81924; 81944-82272; 82300-82303	11	81953, 954, 999, (82)[b] 128, 129, 165, 166, 180, 239, 245, 262
6	409	82273-82299; 82304-82687	2	82372, 526
7	388	82688-83061; 83075-83091	3	82693, 775, 916
8	326	83062-83074; 83092-83407; 83409-83411	5	83178, 189, 222, 231, 248
9	459	83408; 83412-83884	16	83411, 498, 499, 591, 592, 609 612, 614, 618, 662, 667, 669, 725, 785, 787, 819
10	147	83885-84037	4	83908, 921, (84) 026, 029
12	285	84038-84334; 84350-84352	16	84045, 076, 128, 138, 205, 228, 229, 248, 249, 224, 273, 274, 298, 299, 323, 324
13	201	84335-84349; 84353-84549	11	84370, 371, 374, 405, 415, 457, 464, 471, 485, 528, 539
14	34	84550-84566; 84575-84593	2	84575, 589
18	301	84567-84574; 84594-84887; 84900-84908	10	84633, 640, 677, 700, 740, 777, 803, 852, 858, 860
19	184	84888-84899; 84909-85085; 85099	6	84951, 962, 964, (85) 061, 062, 068
		F-82 series		
20	115	032000-032117; 032125-032127	5	032043, 079, 096, 098, 099
22	108	032118-032124; 032128-032230	2	032140, 154
23	106	032231-032321; 032325-032340	1	032312
24	54	032322-032324; 032341-032388; 032400-032403	1	032384
25	109	032389-032399; 032404-032498; 032500-032504	2	032393, 491
26	32	032499; 032505-032521; 032525-032538	-	

Appendix Table 2 (cont'd)

Haul no.	Tagged and released		Missing from series[a]	
	No.	Serial number	No.	Serial number
27	152	032522-032524;032539-032687; 032700-032702	3	032539, 611, 619
28	51	032688-032699;032703-032740; 032750-032751	1	032725
29	250	032741-032749;032752-032995	3	032775, 782, 975
30	23	032996-033013;033025-033029	-	
31	30	033014-033024;033030-033048	-	
32	361	033049-033410	1	033110
33	339	033411-033744;033750-033756	2	033458, 616
34	416	033745-033749;033757-034174	7	033775, 789, 950, (34) 000, 001, 127, 136
35	457	034175-034629;034650-034655	4	034237, 450, 451, 625
36	455	034630-034649;034656-035099	9	034642, 643, 673, 710, 882, 997, (35) 010, 050, 052
37	157	035100-035242;035250-035263	-	
39	322	034243-034249;035264-035584	6	035267, 377, 380, 397, 509, 516
40	56	035585-035640	-	
41	140	035641-035781	-	
42	145	035782-035912;035925-035939	1	035798
43	295	035913-035924;035940-036227	4	035976, (36) 043, 046, 204
44	190	036228-036410;036425-036432	1	036373
45	127	036411-036424;036433-036542; 036551-036556	3	036442, 484, 518
46	272	036543-036550;036557-036815; 036825-036837	8	036559, 563, 564, 776, 779, 784, 753, 790
47	297	036816-036824;036838-037120; 037125-037134	5	036844, 920, 921, 994, (37) 085
48	341	037121-037124;037135-037476	5	037136, 137, 218, 240, 319
49	385	037477-037774;037800-037890	4	037482, 511, 515, 604
50	230	037891-038110;038125-038136	1	038094
51	95	038111-038124;038137-038213; 038225-038229	1	038142
52	283	038214-038224;038230-038508	7	038255, 257, 306, 312, 406, 415, 459
53	67	038509-038562;038575-038589	1	038523
54	116	038563-038574;038590-038694	1	038650
55	154	038695-038849	-	
56	368	038850-039171;039175-039222	2	038866, 868
	10, 612		186	

[a]Includes broken tags, missing tags, paired tags (2 in one fish), and dead fish.
[b]Parentheses indicate next "thousand" in tag series.

Appendix Table 3. Physical condition, by haul, of rock sole tagged in Hecate Strait, April 27-May 11, 1982.

Haul no.	No. tagged	No. dead[a]	No. in poor shape[b]	Type of injury[c]						Total
				B	C	F	L	X	Id	
1	147	-	-	2	-	1	-	-	-	3
2	71	-	2	3	-	-	-	-	-	3
3	64	1	1	-	-	1	-	-	-	1
4	172	1	2	5	-	-	-	-	-	5
5	333	5	3	4	-	1	1	-	1	7
6	409	-	3	2	1	2	-	-	1	6
7	388	-	24	4	1	3	6	1	1	16
8	327	1	1	1	1	2	2	-	-	6
9	460	1	3	6	1	-	5	3	-	15
10	147	-	7	8	1	1	3	1	-	14
12	285	-	7	6	-	1	-	1	-	8
13	207	6	29	4	-	-	2	-	-	6
14	34	-	2	-	-	-	-	-	-	-
18	305	4	15	2	2	8	16	1	1	30
19	184	-	5	7	-	1	-	-	-	8
20	115	-	-	3	-	-	1	1	-	5
22	108	-	4	6	-	4	2	-	-	12
23	106	-	28	4	-	3	5	-	-	12
24	54	-	3	1	-	-	-	-	-	1
25	109	-	2	-	-	-	2	-	-	2
26	32	-	-	2	-	4	1	-	-	7
27	152	-	2	5	-	-	5	-	-	10
28	51	-	4	6	-	1	-	-	-	7
29	251	1	12	8	-	5	1	1	-	15
30	23	-	-	1	-	-	-	-	-	1
31	30	-	1	-	-	-	-	-	-	-
32	361	-	6	7	-	4	8	-	-	19
33	339	-	3	14	-	3	7	1	3	28
34	417	1	2	11	-	1	-	-	-	12
35	458	1	2	11	-	12	5	-	2	30
36	456	1	11	7	-	11	-	-	-	18
37	157	-	2	3	1	7	17	1	-	29
39	322	-	7	9	-	16	27	-	5	57
40	56	-	7	-	-	-	5	-	-	5
41	140	-	-	2	-	9	23	-	2	36
42	146	1	1	5	1	8	12	-	2	28
43	295	-	11	2	1	28	53	1	7	92
44	190	-	14	3	2	4	14	-	2	25
45	127	-	7	3	-	4	1	-	2	10
46	272	-	6	5	3	4	16	2	1	31
47	298	1	2	5	2	4	20	1	3	35
48	341	-	27	10	2	5	24	1	4	46

Appendix Table 3 (cont'd)

Haul no.	No. tagged	No.[a] dead	No. in[b] poor shape	Type of injury[c]						Total
				B	C	F	L	X	I[d]	
49	385	-	14	10	2	13	21	2	6	54
50	230	-	3	11	3	4	11	1	3	33
51	95	-	4	4	-	2	6	-	-	12
52	285	2	7	2	3	4	24	1	3	37
53	67	-	-	2	-	1	-	-	-	3
54	116	-	8	3	1	11	9	-	3	27
55	154	-	5	3	-	12	10	1	3	29
56	368	-	4	7	5	18	29	1	5	65
Total	10,639	27	313	229	33	223	394	22	60	961

[a]No. dead: number of dead specimens removed from holding tank prior to release.

[b]No. in poor shape (observed at time of release): includes sluggish or disoriented fish but not necessarily those which had injuries if the injury did not appear to adversely affect performance.

[c]Type of injury (observed at time of tagging): B = bleeding from tag hole.
C = cut or other flesh wound
F = torn fin(s)
L = scale loss
X = extruded gut
I = other or multiple injuries.

[d]Includes eye damage, abrasions and scars. Note: those fish with multiple injuries involving listed types are also included in the other categories.

Appendix Table 4. Rock sole maturity (numbers sampled) by fishing locality in Hecate Strait, April 27-May 11, 1982.

PMFC Area	Fishing locality	Gonad condition													
		Males							Females						
		1&2	3	4	5	6	7	T	1&2	3	4	5	6	7	T
5C	Reef I. Gully-Cumshewa (inshore)	18	4	16	61	18	17	134	79	75	17	9	132	106	418
	Cumshewa (Reef I. Flats)	12	0	1	8	39	124	184	31	10	3	1	27	97	169
5D	S.W. Seal Rocks(s)	13	1	3	20	18	7	62	45	19	2	1	14	21	102
	S.W. Seal Rocks(n)[a]	20	0	0	11	15	52	98	179	30	5	0	20	164	398
Total								478							1,087

[a]Includes one haul on Butterworth Flats.

Appendix Table 5. Size composition of rock sole tagged in Hecate Strait, April 27-May 11, 1982.

Fork length (cm)	Haul number											
	1	2	3	4	5	6	7	8	9	10	12	13
25	1	-	-	-	-	-	-	-	1	-	-	-
6	1	-	-	-	-	-	-	-	0	-	-	-
7	0	1	-	1	-	1	2	2	1	4	5	2
8	2	2	1	0	-	2	4	4	7	4	8	5
9	0	2	1	3	6	11	3	3	9	15	12	8
30	2	2	2	3	9	20	13	16	20	13	13	11
1	2	2	1	6	13	24	11	11	18	17	13	18
2	6	3	1	6	8	23	7	16	24	13	29	21
3	10	6	2	14	15	31	11	14	30	25	26	11
4	6	6	3	7	18	24	22	15	28	8	29	16
5	10	2	2	10	19	22	27	15	30	12	17	11
6	9	3	3	7	21	33	20	25	31	12	21	17
7	3	2	2	13	24	27	32	33	33	5	16	12
8	10	4	7	15	20	28	34	32	30	3	18	14
9	13	5	1	15	22	34	28	30	23	4	11	12
40	8	7	4	10	36	21	39	23	30	5	17	13
1	19	10	7	10	27	28	30	16	30	2	15	8
2	7	2	7	8	19	20	30	18	31	1	11	7
3	9	3	5	9	26	21	21	17	24	1	10	10
4	8	2	7	14	15	14	26	13	26	3	6	4
5	7	4	2	9	13	9	7	7	7	-	2	3
6	1	1	3	6	3	9	12	6	9	-	4	2
7	4	1	2	4	14	2	7	4	10	-	1	1
8	4	0	2	1	2	1	0	2	4	-	0	1
9	4	1	-	1	1	1	2	3	1	-	1	-
50	1	-	-	1	1	1	-	0	1	-	-	-
1	-	-	-	-	1	-	-	1	2	-	-	-
Total	147	71	65	173	334	409	388	327	460	147	285	207

Appendix Table 5 (cont'd)

Fork length (cm)	Haul number											
	14	18	19	20	22	23	24	25	26	27	28	29
25	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	3	1	2	1	1	-	-	-	1	2	-
8	-	10	2	1	1	1	1	2	-	1	8	1
9	-	18	1	2	5	0	1	4	-	3	5	8
30	2	21	13	7	1	2	1	6	-	11	3	22
1	1	23	17	2	7	6	2	9	2	11	18	24
2	2	30	25	11	8	8	7	8	4	13	4	25
3	1	31	24	22	11	2	4	11	3	23	2	35
4	1	21	10	12	9	10	5	5	4	17	3	36
5	2	33	17	9	7	5	5	7	3	9	0	26
6	1	17	13	13	6	17	5	14	1	17	4	21
7	1	6	11	7	8	12	9	2	4	12	3	14
8	1	12	10	3	7	13	3	4	2	9	5	8
9	3	9	4	6	4	6	2	6	3	9	3	4
40	2	8	7	3	9	3	0	7	2	3	1	5
1	5	4	7	7	2	3	3	5	2	4	-	3
2	0	10	8	3	6	4	3	6	2	2	-	4
3	6	13	8	1	7	4	2	6	-	2	-	5
4	2	15	4	1	3	3	1	2	-	1	-	3
5	2	7	2	2	2	2	-	3	-	2	-	4
6	0	2	-	0	2	1	-	1	-	1	-	1
7	1	2	-	1	2	2	-	1	-	0	-	1
8	1	5	-	-	-	1	-	-	-	0	-	1
9	-	0	-	-	-	-	-	-	-	0	-	-
50	-	3	-	-	-	-	-	-	-	1	-	-
1	-	2	-	-	-	-	-	-	-	-	-	-
Total	34	305	184	115	108	106	54	109	32	152	51	251

Appendix Table 5 (cont'd)

Fork length (cm)	Haul number												
	30	31	32	33	34	35	36	37	39	40	41	42	43
25	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	1	-	1	-	-	1	1	-	-	-	2
8	-	-	2	1	3	2	2	2	1	-	-	-	0
9	-	-	2	0	2	2	2	3	2	-	1	5	5
30	-	-	5	2	6	4	5	4	10	1	1	5	13
1	2	1	11	9	11	8	12	8	15	3	2	12	16
2	1	1	16	9	20	19	18	16	22	1	5	13	18
3	2	2	24	14	23	23	29	10	25	3	13	12	32
4	2	2	23	23	25	35	42	18	29	5	19	9	27
5	0	3	30	18	34	40	49	20	37	6	8	6	36
6	2	2	25	20	38	50	51	27	41	4	15	12	35
7	1	4	35	36	46	33	49	13	24	2	16	14	31
8	3	5	33	32	45	46	46	8	23	5	10	14	25
9	1	3	35	36	43	46	34	10	24	6	8	17	10
40	2	3	29	34	38	45	37	5	17	2	4	7	13
1	0	0	35	30	26	29	35	5	15	3	10	5	9
2	2	0	22	26	22	17	18	2	8	2	13	5	8
3	2	3	15	18	10	24	11	0	11	5	8	4	4
4	2	0	5	12	9	23	5	2	4	2	1	4	2
5	0	1	9	6	5	7	9	1	8	4	4	2	4
6	0	-	2	5	5	2	1	1	5	2	2	-	3
7	0	-	2	3	1	1	1	1	1	-	-	-	0
8	1	-	-	2	1	1	-	-	-	-	-	-	2
9	-	-	-	-	2	0	-	-	-	-	-	-	-
50	-	-	-	-	1	1	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	23	30	361	339	417	458	456	157	322	56	140	146	295

Appendix Table 5 (cont'd)

Fork length (cm)	Haul number												
	44	45	46	47	48	49	50	51	52	53	54	55	56
25	-	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	1	1	-	-	1
7	-	1	-	3	-	1	-	1	2	0	2	2	2
8	1	1	-	2	2	3	2	0	0	0	1	0	7
9	4	5	6	1	2	2	2	5	3	0	5	4	16
30	2	6	10	14	15	8	7	9	8	6	3	6	36
1	9	7	18	9	20	21	17	13	17	7	9	14	26
2	11	8	16	18	27	26	7	10	24	9	15	18	44
3	7	14	24	25	31	32	16	11	30	9	12	18	45
4	16	17	17	32	21	41	22	7	24	8	10	15	39
5	21	17	30	23	30	34	20	2	24	7	16	19	37
6	15	10	36	33	27	31	18	10	35	4	11	16	28
7	15	10	29	27	31	36	15	1	27	4	9	7	25
8	16	5	15	30	34	26	16	5	29	1	7	12	13
9	11	5	18	12	24	32	15	5	11	2	7	5	14
40	16	3	13	17	18	30	9	3	15	4	3	7	15
1	13	7	13	14	17	17	14	4	13	2	3	2	8
2	9	6	11	16	17	9	16	4	6	1	1	4	6
3	5	1	8	6	6	14	7	3	5	2	1	3	1
4	9	2	5	4	9	11	11	2	3	-	1	1	1
5	5	1	3	9	5	7	8	-	5	-	-	0	1
6	4	0	-	2	3	3	4	-	2	-	-	1	1
7	1	0	-	1	2	1	1	-	0	-	-	-	1
8	-	1	-	-	-	-	1	-	1	-	-	-	0
9	-	-	-	-	-	-	2	-	-	-	-	-	0
50	-	-	-	-	-	-	-	-	-	-	-	-	0
1	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	190	127	272	298	341	385	230	95	285	67	116	154	368

Appendix Table 6. Size composition of rock sole examined for gonad condition, by sex and fishing locality in Hecate Strait, April 27-May 11, 1982.

Total length (cm)	Cumshewa (Reef I. Flats)		Reef I. Gully		Cumshewa (inshore)		S.W. Seal Rocks (south)		S.W. Seal Rocks[a] (north)	
21	-	-	-	-	-	-	-	-	1	-
2	-	-	-	-	-	-	-	-	0	1
3	-	-	-	-	-	-	1	1	0	1
4	-	-	3	-	-	-	0	0	1	0
5	-	1	0	-	1	-	1	0	4	5
6	3	2	2	2	2	-	2	0	6	6
7	2	1	3	3	3	-	1	2	2	1
8	3	2	4	1	6	1	5	2	2	6
9	6	0	6	2	6	8	2	2	3	3
30	8	1	14	2	3	8	9	5	9	5
1	8	1	11	7	7	10	9	6	8	15
2	11	2	15	15	4	14	10	2	13	17
3	28	8	14	5	4	8	9	7	19	31
4	25	7	5	10	0	10	4	13	7	25
5	33	11	9	21	1	14	4	15	6	33
6	23	12	3	16	1	7	7	17	7	32
7	20	15	2	31	1	9	2	9	5	30
8	8	21	1	35	-	10	1	11	2	21
9	4	20	-	32	-	12	-	5	-	27
40	1	20	-	22	-	9	-	12	-	34
1	-	10	-	18	-	7	-	6	-	21
2	-	11	-	10	-	5	-	4	-	15
3	-	14	-	10	-	5	-	3	-	5
4	-	3	-	10	-	3	-	5	-	1
5	-	2	-	8	-	2	-	3	-	4
6	-	1	-	4	-	2	-	6	-	1
7	-	2	-	1	-	-	-	1	-	-
8	-	-	-	6	-	-	-	-	-	-
9	-	-	-	1	-	-	-	-	-	-
50	-	-	-	0	-	-	-	-	-	-
1	-	-	-	1	-	-	-	-	-	-
Total	183	167	92	273	39	144	67	137	95	340

[a]Includes one haul (#56) on Butterworth flats.

Appendix Table 7. Size composition of Pacific cod sampled during Hecate Strait tagging charter, April 27-May 11, 1982.

Fork[a] length (cm)	Haul number 11	21			50
	U[b]	M	F	U	U
23	1	-	-	-	4
6	0	-	-	-	12
9	11	-	-	-	14
32	44	-	-	-	1
5	27	-	-	-	-
8	54	-	-	1	-
41	79	2	-	1	-
4	31	1	-	1	-
7	3	1	-	6	-
50	5	4	4	9	-
3	0	4	5	4	-
6	0	4	5	24	-
9	1	15	15	3	-
62	-	9	12	19	-
5	-	4	10	24	-
8	-	4	9	18	-
71	-	-	3	19	-
4	-	-	1	10	-
7	-	-	2	-	-
80	-	-	0	-	-
3	-	-	1	-	-
Total	256	48	67	139	31

[a]Original data collected by 1 cm interval.

[b]U = unsexed sample.